Chapter 4

CSO Control Program Review

In 1999, when it adopted the Regional Wastewater Services Plan (RWSP), the Metropolitan King County Council recognized that the RWSP was a complex and dynamic plan that would require regular review and updates. The Council specifically called for a review of the benefits of the CSO control program. No new CSO control projects were to be undertaken until after completion of the review.

To conduct the review of the CSO control program, King County staff have been gathering and assessing information over the last few years. The review has identified areas of efficiency and success, as well as areas where improvements could be made. These improvements are being implemented. The findings of this review will provide substantive information to the remaining planning for the 2008 CSO plan update, leading to further refinements of the control program and projects. WTD recognizes the value of this type of review and plans to conduct similar reviews on a regular basis ahead of control plan updates. The next review will occur in 2010.

This chapter describes the review process, its conclusions, and any remaining issues. It is organized according to the topics listed in the RWSP policy for the CSO control program review:

- Maximizing the use of existing CSO control facilities
- Identifying the public and environmental health benefits of continuing the CSO control program
- Ensuring that projects are in compliance with new regulatory requirements and objectives such as the Endangered Species Act and the Wastewater Habitat Conservation Plan
- Analyzing rate impacts
- Ensuring the program review will honor and be consistent with long-standing commitments
- Assessing public opinion
- Integrating the CSO control program with other water and sediment quality improvement programs for the region

4.1 Maximizing the Use of Existing CSO Control Facilities

In the Wet Weather Water Quality Act of 2000 (H.R. 4577, 33 U.D.C. 1342(q)), the U.S. Environmental Protection Agency (EPA) requires the implementation of Nine Minimum Controls to reduce CSOs (see Chapter 3). These controls emphasize methods, such as operational controls, that can be implemented faster than costly capital projects. These controls are included

in the County's NPDES permit for the West Point Treatment Plant. Three of the Nine Minimum Controls are relevant to maximizing the use of existing CSO control facilities:

- Implement proper operation and regular maintenance programs for the sewer system and CSOs
- Maximize use of collection system for storage
- Maximize flow to secondary treatment plant for treatment

These controls were used as the basis for the review of the use of CSO facilities. The review included physically inspecting each CSO facility and rain gauge to supplement ongoing inspection programs, reviewing monitoring data, and making improvements based on the inspections and review. The scope was then broadened to include topics such as control program organization, coordination, and communication as means to effective program implementation. The first step was to inventory roles and responsibilities within WTD that relate to these tasks. A workshop and follow-up meetings were held across the division not only to identify ways to maximize the use of existing facilities but also to improve the coordination framework and methodologies that implement the program. These meetings were followed by a survey of staff to identify their communication needs and various approaches to meet these needs.

To ensure that combined sewage receives the best treatment possible, the program strategy is to send as much flow as possible to regional treatment plants. CSO control facilities, such as storage or satellite treatment, are built to manage peak flows. As such, they operate as backup to the transfer of flows to regional treatment plants—operating only when flows cannot be managed immediately at regional plants. These CSO facilities may be used only a few times a year to achieve the regulatory control standard. The strategy is implemented in the following order: (1) direct transfer to a regional plant, (2) inline storage, followed by transfer to a regional plant, (3) offline storage in facilities such as tunnels or tanks, followed by transfer to a regional plant, and (4) satellite CSO treatment and discharge.

The remainder of this section discusses the inspections of CSO facilities and rain gauges and the review of monitoring data and CSO control status. Appendix C describes the approach and results of the staff inventory, workshop, and survey.

4.1.1 Inspections of CSO Facilities and Rain Gauges

As a part of the CSO program review, the outfall for each CSO facility was located and its coordinates were updated via global positioning system for input to the County's geographic information system (GIS). In addition, monitoring equipment was checked for proper functioning. These checks identified a few needed corrections, such as moving a flow monitor to another location. Corrections are completed or in progress.

Rain gauges provide information for both system operation and facilities planning. As a part of this review, all gauges were inspected and recalibrated and a system was put in place to provide

regular checks. Meetings were held between planning, offsite, and engineering staff to review set-points.[1] Discussions identified improvements to decision processes and changes to set-points.

The review of monitoring data (discussed in the next section) identified the need for additional improvements. In one location, reports of zero overflow were found to be the result of a lost data link in the software. In another location—the Montlake CSO—a recent trend of increased overflows led to an inspection of the Montlake siphon. The siphon was found to be about 75 percent obstructed, and a major cleaning was implemented. The identification of this unexpected obstruction prompted the scheduling of inspections of other siphons in the system. Subsequent inspection of the Ballard siphon identified significant concerns that require immediate repair or replacement. This work is under way. Normal inspections and data assessment would likely have identified these problems, but this review accelerated their correction.

4.1.2 Review of Monitoring Data and Status of CSO Control

Monitoring data were reviewed for any trends or changes. Data for the last 5 years indicate that the period had lower than average rainfall. As a result, the average annual CSO volume is about half that predicted by the model. More recent work done for this program review indicates that the model needs to be updated and recalibrated. This process is under way and should be complete in 2007.

King County's CSO plan was based on the assumption that the City of Seattle had controlled most of its CSOs. However, since adoption of the RWSP, the City monitored all of its CSO locations and found that several are not controlled. In 2001, the City amended its plan to control these remaining CSOs by storing and then transferring these flows to the King County conveyance system for transport and treatment at regional plants. The City has committed to building its storage facilities large enough so that City flows do not increase overflows at King County CSO locations. The City will need to work with the County to assess the impacts of its projects on downstream County facilities and the capacity of the West Point Treatment Plant to accept City flows for treatment. This will be a challenging coordination as both agencies are now competing for the same remaining system capacity for their captured CSO flows.

4.2 Identifying the Public and Environmental Health Benefits of Continuing the CSO Control Program

For this CSO control program review, WTD took a fresh look at existing information, reviewed new information, and completed studies to assess—both quantitatively and qualitatively—the health benefits to the public, environment, and endangered species of completing the program. The assessment drew from studies describing existing environmental conditions and predicted

[1] Set-points are flow levels at which controls adjust pump speeds and operate regulator and outfall gates to store or discharge flows.

conditions at the completion of the program. It built on the findings of the County's 1998 *Water Quality Assessment of the Duwamish River and Elliott Bay* (WQA) and 1999 *Sediment Management Plan*—both done in support of the RWSP—and on annual water quality reports.

Studies conducted to better understand how to protect fish species listed as threatened under the Endangered Species Act (ESA) provided insight into the life stages of these species and the effects of degraded water, sediment, and habitat on their survival. WTD helped to generate some of this information through its participation in Watershed Resource Inventory Areas (WRIA) groups in King County, initiation of a Habitat Conservation Plan, and review of CSO occurrence in relation to presence of juvenile chinook salmon. Also reviewed were published findings from the studies being conducted in support of contaminated sediment cleanup in the Duwamish River, which present some of the most current science available that is relevant to CSO control planning. Finally, the most recent science on climate change and sea level rise in the Puget Sound was reviewed for issues that may affect CSO planning.

This section summarizes the implications of this information for King County's CSO control program and then further describes the information. Greater detail is provided in Appendix C.

4.2.1 Summary of Public and Environmental Health Information and its Relation to CSO Control

Knowledge from recent scientific studies does not warrant any change in course. The findings from the review reinforce the direction of the RWSP CSO control plan. King County is committed to controlling all remaining CSO sites by 2030. The RWSP priorities to protect human health, endangered species, and the environment remain valid. Under the RWSP schedule, design will begin in mid 2006 on projects with the greatest benefit to human health protection—the Puget Sound Beach projects. Control projects will continue to be designed to transfer as much captured CSO flow as possible to regional plants for secondary treatment.

The studies underscore the finding of the 1998 WQA that the primary benefit of the planned CSO control will be the reduction of risks to humans from pathogens in the area near each CSO. The improvement from these reductions, however, may be barely perceptible on a watershed level because CSO discharges contribute pathogens for only short periods while other sources, such as upstream stormwater agriculture run-off or leaking septic systems, are contributing high levels of pathogens on an ongoing basis.

Possible effects from bioaccumulating and endocrine-disrupting chemicals (EDCs) are being documented in the scientific literature.[2] The literature seems to indicate that the length and frequency of exposure in the water column are significant factors related to potential effect. However, risks resulting from CSOs appear to be low because the chemical concentrations in the water column are low and exposure is brief and infrequent. It is expected that international

[2] In bioaccumulation, low concentrations of chemicals build up in the food web to levels resulting in tissue concentrations that are harmful to aquatic organisms or to those that prey on them, including humans. Endocrine-disrupting chemicals mimic, inhibit, or alter the hormonal regulation of animal systems, such as the immune, reproductive, or nervous system or other parts of the endocrine system.

studies will continue until definitive answers are known and regulations instituted. King County will support research through organizations such as the Water Environment Research Foundation, will monitor evolving knowledge, will emphasize pollution prevention programs, and will explore new ways to test for EDCs using better low-level detection methods at its environmental lab.

Many recent studies have focused on the Duwamish River because of sediment cleanup projects in the area. With regard to protection of human health, information generated from the Lower Duwamish Waterway Superfund process is increasing our understanding of fish consumption and human health risk. Studies under way may shed more light on whether these risks result from historical sediment contamination or from an ongoing contribution from CSOs and other sources. If an ongoing human health risk from CSOs in the Duwamish River is identified, King County may consider changes in the control schedule to accelerate CSO control projects at those locations. Determining remaining relative priorities of projects scheduled for completion after the Puget Sound beach projects will be difficult because comparable information is not as available for other areas where CSOs occur, such as Elliott Bay, the Ship Canal, and the East and West Waterways of the Duwamish River.

With regard to protection of salmon, the perception that CSOs are harmful must consider that the area with the greatest volume of overflow—the Duwamish River—has the healthiest run in terms of numbers of both hatchery and naturally spawning fish. At this time, protection of endangered salmon does not appear to be enhanced by changes in the CSO control schedule that would prioritize the Duwamish over other locations.

Much uncertainty still remains in the available scientific knowledge and its applicability to CSO control. In the face of these uncertainties, WTD should continue to place emphasis on source control for pollutants of concern, on CSO control alternatives that promote storage and transport to regional plants for secondary treatment, and on the cleanup of areas with contaminated sediment. WTD will continue to monitor scientific studies, conduct its own studies when needed, and track water quality trends. Any recommended schedule changes to address new scientific information will be available for public discussion ahead of the next CSO control program review in 2010; any information that is available earlier will be incorporated into the 2008 CSO control plan update.

4.2.2 Description of Recent Studies and Activities Relating to Public and Environmental Health

The following sections describe ESA-related studies, sediment management activities and studies near CSO locations, and recent information on climate change and sea-level rise.

4.2.2.1 Studies in Support of Protection of Threatened Species Under ESA

Since the listing of bull trout and chinook salmon as threatened species under the ESA, King County has participated in or has taken the lead on studies to better understand the factors affecting the health of these species and to develop ways to protect them. WTD supports the

multi-jurisdictional watershed planning efforts for the watersheds in King County. The Salmon Conservation Plans developed for the watersheds recommend actions in the lower reaches that should be considered in CSO planning.

Also in response to the ESA listings, WTD voluntarily began development of a Habitat Conservation Plan (HCP) for all its activities that could have an effect on these species. Although WTD ultimately decided that the commitment of resources required to match the uncertainty level was too substantial to continue the HCP process, the studies done on persistent bioaccumulative toxins and EDCs in support of the HCP provided valuable direction for WTD activities and future studies.

Finally, as part of this CSO program review, WTD conducted an assessment of the presence and abundance of juvenile chinook salmon in comparison with average exposure to CSOs. The findings of the assessment contribute to the discussion of priorities for CSO control.

The following sections describe this information in more detail.

Presence of Threatened Species in the Watersheds

CSOs occur in the lower reaches of each of the two primary watersheds in King County's wastewater service area (Figure 4-1). These watersheds—called Water Resource Inventory Areas (WRIAs)—are the Lake Washington/Cedar/Sammamish watershed (WRIA 8) and the Green/Duwamish and Central Puget Sound watershed (WRIA 9).

In WRIA 8, King County CSOs in Lake Washington are controlled but uncontrolled CSOs remain in the Ship Canal and the nearshore area near Carkeek Park. Three chinook salmon populations migrate in and out of the watershed through the lakes, Ship Canal, and Locks. Juveniles rear in the marine nearshore areas of Puget Sound before heading into the ocean. Studies indicate that all three populations are at extremely high risk of extinction. The Cedar River population is at highest risk, followed by North Lake Washington and then Issaquah populations.[3]

In WRIA 9, King County CSOs are located in the lower Duwamish River from the turning basin to the mouth, in Elliott Bay, and along the Alki shoreline. The Green/Duwamish River system has not experienced the same decline in chinook salmon as has occurred in other systems. Currently, the system supports an average yearly total run (fish returning to the river and those caught in fisheries) of about 41,000 adult chinook salmon. Overall, Green River chinook are resilient and have survived the effects of large-scale production of hatchery fish, high harvest rates, and habitat alteration (Figure 4-2).[4]

[3] September 2002. *Salmon and Steelhead Limiting Factors Report for the Cedar Sammamish Basin (Water Resource Inventory Area 8).*

[4] December 2000. *WRIA 9 Habitat Limiting Factors and Reconnaissance Assessment for Salmon Habitat in the Green/Duwamish and Central Puget Sound Watershed.*

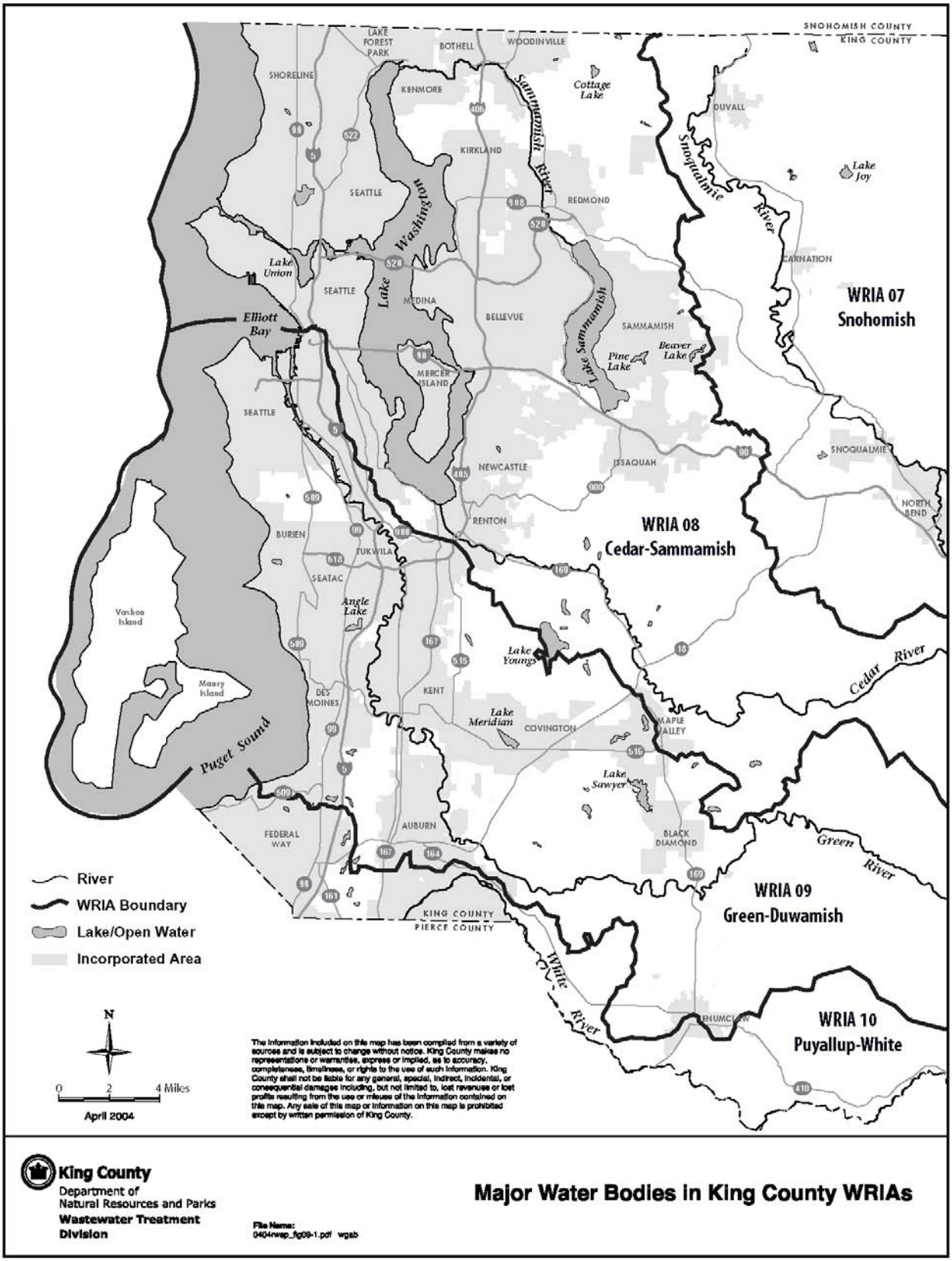

Figure 4-1. Major Water Bodies in King County WRIAs

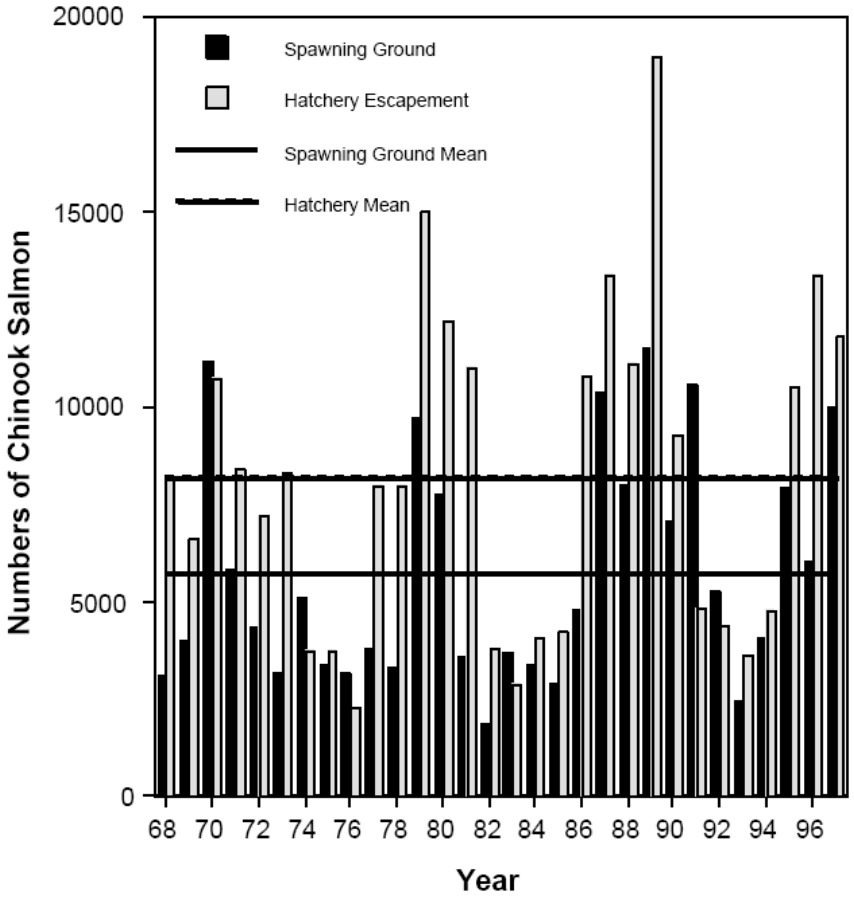

Figure 3. Time series of chinook salmon returning to the spawning grounds and to the hatcheries, 1968-1997. Spawning ground estimates include an unknown number of stray hatchery salmon. Mean values are shown. Data source: WDFW 1998.

Figure 4-2. Time Series of Green River Chinook Salmon Returning to the Spawning Grounds and to the Hatcheries, 1968–1997[5]

Given the varied life history strategies of bull trout and the limited information regarding the species, the U.S. Fish and Wildlife Service (USFWS) assumes the presence of bull trout everywhere in their historical range unless proven otherwise. Bull trout are likely to occur in the same water bodies, except for Lake Washington, as outmigrating juvenile chinook (which they prey on).

[5] Source for Figure 4-2: December 2000, *WRIA 9 Habitat Limiting Factors and Reconnaissance Assessment for Salmon Habitat in the Green/Duwamish and Central Puget Sound Watershed*.

Presence of Chinook Compared to a Water Body's Exposure to CSOs

As part of this CSO program review, the presence and abundance of juvenile chinook salmon were compared with average exposure to CSOs in the Duwamish River and other water bodies where CSOs occur. The previous 5 years of discharge frequencies and volumes were graphed by month and then superimposed on a graph showing the presence and relative abundance of chinook. In general, the majority of juvenile chinook salmon are present during periods of the fewest discharges and the smallest volumes. This relationship is illustrated in the graph for the Duwamish River (Figure 4-3).

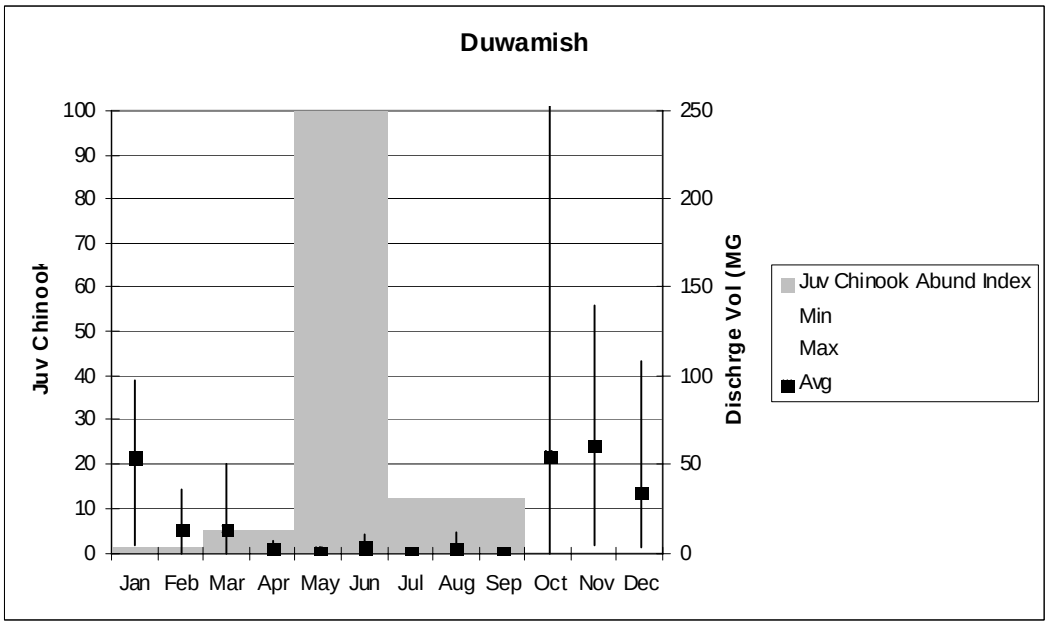

Figure 4-3. Presence of Duwamish River Chinook During CSO Discharge—Monthly Average Volume, 1999–2004

Given the finding that most juvenile chinook are near CSO outfalls when very little CSO discharge activity occurs and given that chemicals in CSOs are diluted through mixing, it was concluded that CSO discharges present little measurable harm to juvenile chinook. Additionally, because the essence of an ESA-based evaluation is a comparison between existing and future conditions, implementation of the CSO control plan will show a consistent improvement in habitat quality over time.

Salmon Conservation Plans: Strategies for Improving Habitat

A Salmon Conservation Plan was published for WRIA 8 in July 2005 and for WRIA 9 in August 2005. The plans describe long-term habitat conservation and recovery actions in WRIAs 8 and 9 that take an ecological approach but concentrate on the needs of the ESA-listed species of

chinook salmon and bull trout. They include strategies, policies, and recommended projects to address factors that limit salmon habitat in the watersheds.[6]

Both WRIA plans recommend actions in the lower reaches of the watersheds that should be considered in CSO planning. One of the many recommended actions is to increase efforts to protect sediment and water quality, especially near commercial and industrial areas where there is the potential for fuel spills, discharge of pollutants, and degraded stormwater quality. While CSOs were not considered as a major concern in the plans, there is the perception that CSOs contribute to the degradation of water and sediment quality in salmon habitat. Associated with this perception is a larger concern about impacts from stormwater.

Habitat quality in the transitional areas of the estuaries is a priority. The WRIA 8 plan recommends the creation of pocket estuaries in the Ship Canal near the Hiram M. Chittenden Locks in order to increase the estuary area transition zone; the WRIA 9 plan recommends enlargement of the Duwamish estuarine transition zone habitat by expanding the shallow water and slow water areas. The WRIA 9 plan specifically recommends that area projects be leveraged to create improved habitat. Future CSO control projects may be assessed as opportunities to make needed habit improvements.

Potential for Secondary Effluent to Contribute to Chemicals in the Puget Sound Food Web

The listing of bull trout and chinook salmon as threatened under the ESA prompted WTD to undertake the creation of a Habitat Conservation Plan (HCP) for all WTD activities that have the potential to impact these species. The HCP was proposed as a voluntary, two-phased, 40-year agreement with NOAA Fisheries and USFWS (the Services) that would outline WTD's efforts to protect threatened and endangered species while carrying on its wastewater management activities.[7] The HCP effort was stopped in April 2005, after completion of Phase I, because the uncertainties uncovered were so large that the commitment of resources required to match the uncertainty level was deemed unacceptable. WTD chose, instead, to seek individual ESA consultations for projects with a federal link.

Before the HCP process was halted, the process produced valuable information that was reviewed for its applicability to CSO control. In one study, available data were reviewed to identify the types of chemicals that are bioaccumulating in the Puget Sound food web and to assess the potential for King County secondary treatment plant effluent discharges to contribute to this bioaccumulation. The study identified some persistent bioaccumulative toxins (PBTs) that are accumulating in the food web. Compared to other sources, WTD secondary effluent does not appear to be a significant contributor of these chemicals. There were not enough data to determine the effluent's contribution to mercury accumulations. As a precaution, WTD adopted

[6] These habit-limiting factors were documented in the Washington Conservation Commission's December 2000 *Habitat Limiting Factors and Reconnaissance Assessment Report for the Green/Duwamish and Central Puget Sound Watersheds (Water Resource Inventory Area 9)* and September 2002 *Salmon and Steelhead Limiting Factors Report for the Cedar Sammamish Basin (Water Resource Inventory Area 8).*

[7] NOAA = National Oceanic and Atmospheric Administration.

specific rules to limit mercury discharges by local area dentists, the greatest known source of mercury, into the wastewater collection system.

In addition, current scientific literature on endocrine disrupting chemicals (EDCs) was reviewed for the presence of these chemicals in wastewater effluents and their effects on aquatic species. There is evidence linking exposure to EDCs with effects on aquatic organisms. In general, however, the review concluded that there is inadequate knowledge of which chemicals exert endocrine disrupting effects, the biological and ecological significance of these effects, and their mechanistic bases.

The information from these studies is not directly applicable to CSOs because secondary treatment removes a portion of these chemicals from the wastewater stream; however, it does reinforce the value of continuing to maximize the amount of CSO flow that is sent to regional plants for treatment. It appears that the risks to the food web resulting from CSOs appear to be low. The chemical concentrations in CSOs are low and exposure is brief and infrequent. Studies will continue until definitive answers are known and regulations instituted.

4.2.2.2 Sediment Management and CSO Control

In recognition that management of contaminated sediments was emerging as an important environmental issue with implications for CSO control, the RWSP called for the development of a sediment management plan (SMP). The SMP was completed in 1999. It highlights the need to learn more about CSOs as possible current and historical contributors to contamination and to address sediment quality issues near CSO discharges and treatment plant outfalls. Recommended remediation projects are described in Appendix C.

Since completion of the SMP, King County is coordinating its sediment management efforts in the Duwamish River with two federal Superfund projects: the Harbor Island and the Lower Duwamish Waterway projects. Superfund is a highly structured and visible approach to managing sediment contamination. Because the process can impose projects and schedules that may not coincide with existing plans, schedules, and budgets, it is in WTD's interests to participate in decisions as early as possible.

King County's participation in the Harbor Island Superfund project began recently after the site was extended across the East Waterway of the Duwamish River to include the Port of Seattle's dredging project near the County's Lander and Hanford CSOs. King County will participate in the current East Waterway Superfund process and incorporate the remediations near the Lander and Hanford CSO sites into the larger response. In December 2000, King County, the Port of Seattle, the City of Seattle, and Boeing entered into an Administrative Order on Consent with EPA and the Washington State Department of Ecology (Ecology) for the Lower Duwamish Waterway (LDW) Superfund site. The County, City, Port, and Boeing voluntarily became involved early in the process before the site was listed under Superfund. Because of this early involvement, these entities are being allowed to undertake the basic work for the initial remedial investigation and feasibility study (RI/FS).

Although they do not relate directly to CSO control, the RI/FS studies do represent state-of-the art knowledge about aspects of environmental and human health related to the Duwamish River

where many County CSOs occur. Phase 1 of the RI examined existing data on the risks to human health and the environment from sediment-associated chemicals in the LDW. The risk estimates were high enough to support moving forward with early action remediations. Two of the seven early action sites were near King County CSOs: Norfolk and Diagonal/Duwamish. Sediment near the Norfolk site had already been remediated in 1999; remediation of the Diagonal/Duwamish sediment was completed in 2004. Both projects were completed by King County, the City of Seattle, and the Elliott Bay/Duwamish Restoration Program (EBDRP).[8] Phase 2, scheduled for completion in 2007, will fill the data gaps identified in Phase 1 and will estimate risks that remain after completion of early remedial actions. Phase 2 findings may have implications for CSO control planning.

Preliminary Phase 2 RI findings point in directions that the CSO control program will need to consider in the future. Although fish exposure projections do not warrant alteration of the CSO control plan at this time, emerging information will need to be followed closely. Recent EPA guidance for the Phase 2 human health risk assessment requires the use of fish consumption studies developed by local tribes. The much higher consumption rates will increase the estimated risks to human health. Preliminary Phase 2 results also suggest that current sediment quality targets for human health may not be adequately protective and may need to be reviewed. While there is no direct link to CSOs as a cause at this time, the increased attention and concern may influence control and schedule decisions.

Five years of post-remediation monitoring at the Norfolk site did not detect sediment recontamination. One sample in the last year showed unexpected contamination. So far, no link between this contamination and ongoing CSO discharges has been found. One year of monitoring at the Diagonal/Duwamish site has found that PCB concentrations are approaching the Sediment Quality Standards in the cleanup area and that phthalates have significantly increased in the sediment cap. Phthalates come from a variety of sources, perhaps in low levels that add up across many inputs.[9] They are very difficult to control. If the trend cannot be reversed, concentrations in the cap could reach pre-cleanup levels. These findings may prompt considerations regarding the acceleration of CSO control; however, discerning and remedying the causes of recontamination will almost certainly prove to be more complex than simply controlling CSOs. Phthalate removal efficiency will be included in the pilot tests of promising CSO treatment technologies that will begin in 2006. (See the section in this chapter on "Analyzing Rate Impacts.") Considerable discussion is occurring on this topic, and progress will be reported in the 2008 CSO plan update and 2010 CSO program review.

See Appendix C for additional detail on sediment management activities and studies.

4.2.2.3 Climate Change, Sea-Level Rise, and CSO Control

On October 27, 2005, King County Executive Ron Sims called together experts from across the country in a conference to discuss the latest information on global warming and climate change

[8] The Elliott Bay/Duwamish Restoration Program administers projects funded under a 1990 settlement of litigation by the National Oceanic and Atmospheric Administration (NOAA) for natural resource damages from Seattle and King County CSOs and storm drains.

[9] Inputs may include stormwater (via vehicular traffic), wastewater (via everyday products), and air deposition.

and to begin a conversation on their implications to providers of public services in the Pacific Northwest. Despite differing opinions on the details and climate models, there is broad scientific consensus that climate change is occurring; that human actions, especially the creation of greenhouse gases by burning fossil fuels, are contributing to these changes; and that steps need to be taken to both prepare for the expected effects of climate change and to possibly prevent them from worsening.

Sea-level rise is an important impact of climate change. Melting of the polar caps, increased river flow, and disruption of climate patterns such as the El Niño will raise sea level and increase the severity of storms and storm surges in parts of the Northwest coast. Low-lying areas are already at risk from projected average sea-level rise and are at even greater risk from average sea-level rise combined with storm waves, accelerated erosion at the base of bluffs and along the coast, and shrinking wetlands.

Compounding sea-level rise are geological forces related to the uplift or subsidence (sinking) of the land surface as tectonic plates converge (move toward or under one another). On the Washington coast, uplift may offset sea-level rise caused by climate change. The southern portion of Puget Sound, on the other hand, is sinking at up to 0.08 inch per year, or about an inch every 12 years. As a result of this subsidence, risks of sea-level rise are greatest in southern Puget Sound. A rise of 12 to 32 inches over a 75-year period is projected for Puget Sound.

WTD will monitor the growing information on climate change and sea-level rise. The design of new CSO control facilities or of modifications to existing facilities will consider climate impacts and sea-level change anticipated during the life of the facility. Possible accommodations could include increased sizing, higher facility elevations with respect to nearby water bodies, increased pumping, and enhanced flood and storm surge protections. Decisions as to when to implement these design features will be made based on when it would be most cost-effective to do so while still meeting the need.

Appendix C provides more detail on climate change and sea-level rise.

4.3 Ensuring that Projects Are in Compliance with New Regulatory Requirements and Objectives Such as the Endangered Species Act and the Wastewater Habitat Conservation Plan

King County has a strong history of compliance with regulations regarding its CSO discharges—both treated and untreated. The County also responds quickly to changes in regulations and even works to anticipate these changes.

WTD's CSO treatment facilities meet the NPDES discharge limits with few exceptions. The CSO control plan laid out in the RWSP was devised to ensure that the County continues to make

steady progress in meeting Ecology's CSO control standard of an average of one untreated CSO discharge per year at each CSO location by 2030.

The design of CSO control facilities must consider not only current regulatory requirements but also possible changes in the requirements in the next 5 to 10 years. Being proactive allows the County to begin conducting studies and modifying projects and programs in advance. In that way, programs and projects can be budgeted to account for the regulations, planning can proceed on facilities that take many years to design and construct, and costly future modifications to facilities can be reduced. Ways to account for future changes is to keep abreast of regulatory trends and to work with Ecology and other regulatory agencies as they develop new regulations. This collaborative strategy is in keeping with RWSP policy that directs WTD to work with state and federal agencies to develop cost-effective regulations and permit methodologies that protect water quality.

Even with this ongoing vigilance, unexpected changes in regulations and methodologies to implement the regulations can occur that may affect program planning and implementation. For example, between the planning phase and the NPDES permitting of the new Mercer/Elliott West and Henderson/Norfolk CSO storage and treatment facilities, Ecology changed the methods to identify the need for and define effluent permit limits. WTD will monitor these facilities for their compliance with these permit limits and will include the new methods in planning for future projects. In addition, promising treatment technologies will be evaluated for their ability to meet possible future requirements in pilot projects proposed for 2006–2009. (See the section on "Analyzing Rate Impacts" for a discussion of the evaluation of treatment technologies.)

The following sections describe WTD's efforts to comply with the Endangered Species Act and the effects on CSO control planning of new water quality regulations and permit compliance methodologies promulgated by Ecology since adoption of the RSWP.

4.3.1 Compliance with Endangered Species Act

The previous section in this chapter on "Identifying the Public and Environmental Health Benefits of Continuing the CSO Control Program" describes WTD's efforts to ensure that its activities, including CSO control, comply with the Endangered Species Act (ESA).

WTD considers the protection of endangered and threatened aquatic species to be an important part of CSO control planning decisions. Its habitat conservation planning process, begun to ensure that operations comply with ESA, produced important studies that have advanced the degree of knowledge regarding chemicals accumulating in the Puget Sound food web. At the same time, these studies brought to light uncertainties regarding the effects of these chemicals on aquatic species and the role of effluent in contributing to the pollution. Uncertainties also exist in regard to whether CSO control projects will require ESA consultations, because only projects with a federal link require such consultations.

4.3.2 Use-Based Water Quality Standards

In June 2003, Ecology made changes to state water quality standards. The new "use-based" standards are based on improving the quality of a water body to support uses by humans and aquatic species that are more specifically defined than in the previous standards. These changes may affect the design and operation of CSO treatment facilities that will discharge to the Duwamish River.

Most of the water bodies where County CSOs occur are included on Ecology's 303(d) list for exceedance of standards for some water quality parameters. The possible impacts on CSO control planning of Total Maximum Daily Load (TMDL) allocations is uncertain because TMDLs have not yet been developed for these waters.[10] To take a proactive stance in the process, the County partnered with Ecology to develop a model sediment TMDL. The purpose of collaboration was to ensure that TMDLs are technically sound and do not duplicate or conflict with other regulations. The model sediment TMDL, completed in 2001, was applied to Bellingham Bay, one of the first sediment TMDLs in the nation approved by EPA.

4.3.3 Water Quality–Based NPDES Permitting

A critical development since the RWSP is the inclusion of water–quality based limits to the permitting of CSO treatment facilities and changes in the methodologies underlying that permitting.

In the 1990s, the County had converted two former primary treatment plants—Alki and Carkeek—to CSO treatment plants. These plants were designed to meet the technology-based standards for solids control. At the time the plants were converted, effluent chemical concentration limits to protect aquatic species in the waters receiving the discharges—called water quality–based limits—were not expected to be applied to the infrequent, intermittent discharges from these plants.

In Washington State, technology-based standards require CSO treatment to be "equivalent to primary," defined as achieving an annual average of 50 percent total suspended solids (TSS) removal and an annual average effluent quality of no more than 0.3 mL/L/hr of settleable solids (SS), with disinfection if needed. When the captured solids are piped to West Point, the percent of TSS removal for CSOs must be adjusted down to account for the losses that will occur in the subsequent treatment process. While Alki and Carkeek have always provided disinfection to any flows discharged to Puget Sound, the new NPDES permit that became effective January 1, 2004, (a part of the West Point permit) includes the requirement to disinfect discharges to meet water quality–based limits starting January 1, 2006. Dechlorination is now required to meet these limits.

[10] Once it is included on the 303(d) list, the water body must be studied and controls must be put into place that will correct conditions so that it meets standards. Controls often involve dividing the pollutant load into allocations to its sources, such as stormwater runoff and municipal or industrial discharges, that the water body can assimilate and still meet the standards. This process is called a Total Maximum Daily Load (TMDL).

Technology-based standards were the compliance objective in 1997 when the facilities plan for the Mercer/Elliott West storage and treatment project was approved. The facilities were the first new CSO treatment facilities to be designed in Washington State. At the time, Ecology and EPA methodologies to assess CSO treatment project alternatives for their expected performance in meeting water quality standards were very limited and no water quality–based permit limits were expected. After considerable discussion with Ecology, County staff proposed methods to predict treated CSO effluent dilution that paralleled those used for secondary plants and developed alternatives whose effluent would meet water quality standards with that dilution.

Between approval of the Mercer/Elliott West facilities plan and NPDES permitting of the new CSO treatment facilities in 2005, methodologies to define CSO effluent dilution have become more concrete (using more stringent stormwater methodologies). These methologies are now expected to be applied to treated CSO discharges, as evidenced by the Alki and Carkeek permit limits. These permitting goals are stricter than anticipated and may prove difficult for the new CSO treatment facilities to meet. Preliminary assessments indicate that treatment of CSOs containing dissolved copper, and possibly ammonia and dissolved zinc, may require enhanced management such as increased dilution, improved treatment technologies, and enhanced source control. Ecology has postponed decisions on water quality–based permit limits for these facilities until they can be made using actual treated effluent data. King County will also initiate discussions with Ecology to clarify how water quality–based standards will be applied.

Continued change is likely. Some environmental groups are requesting that Ecology require that standards for persistent and bioaccumulative chemicals be met at the end of pipes rather than at the edge of mixing zones. And developments for the Lower Duwamish Waterway Superfund effort may lead to more stringent sediment-driven standards and water quality–based and technology-based permit limits. King County will monitor new developments.

4.4 Analyzing Rate Impacts

The RWSP CSO control program recommended that 21 projects be built between 2005 and 2030. The total project constant capital cost for these projects was estimated to be $311 million in 1998. In 2005 dollars, the projects are estimated to cost $383 million.[11] The project schedule for the RWSP CSO control program was designed to spread costs over time and to support a stable sewer rate. The current RWSP program without any recommended refinements and updated estimating will contribute $0.27 per month to rates in 2010, $2.45 in 2020, and $4.65 in 2030.[12]

[11] In addition to accounting for 3 percent per year inflation, this total reflects the deletion of the SW Alaska Street CSO project and the addition of CSO plan updates and sediment management activities that were mandated but not funded in the RWSP. (Monitoring and analysis indicate that the CSO at SW Alaska Street is controlled.) See Appendix C for a table that summarizes current RWSP project costs.

[12] These rates include 3 percent inflation per year, starting from 2005 dollars. The rates without inflation would be $0.23, $1.63, and $2.22 for the same years.

4.4.1 Cost Estimating for CSO Control Projects

Cost estimating involves a narrowing process so as to limit resources and time spent on alternatives that will eventually be discarded for technical or cost reasons. The accuracy of cost estimates increases as projects become more defined and are specified in greater detail. Planning-level cost estimates, such as those used in the RWSP, are based on generic facility concepts. Specific details of the project such as location, technologies, and environmental impacts are determined later during project predesign. Planning level cost estimates are expected to be within +/- 30–50 percent of the final cost, with the wider range assigned when there is greater uncertainty about the project or greater risk to construct. By the time a project enters construction, estimates are typically within +/- 10 percent of the final cost.

Cost estimating methodologies change and improve over time. Since the RWSP, WTD has made several changes—including the use of improved construction and allied cost estimating models—to ensure that cost estimating is more standardized and consistent across projects.

No detailed analysis of CSO project costs has been done since the RWSP because an update of the hydraulic model—recommended by this review and currently under way—will likely change sizes, definitions, and thus costs of several planned control projects. However, similar to increased estimates seen for the original RWSP "North Plant" (Brightwater) and conveyance program, increased estimates for CSO control projects can be expected. Cost estimates may increase as the result of a number of factors, including greater definition of facility design, changes to accommodate new regulations and odor control policies, and increases in materials and contractor costs in this competitive construction environment.[13] WTD has begun two activities that have the potential to offset cost increases that appear could result from changes in market conditions and estimating methods:

- The hydraulic model is being updated and calibrated so that it can more accurately update and refine project sizing.
- Pilot tests will be conducted on promising new CSO treatment technologies that may reduce facility footprint and cost.

These activities are expected to produce new project definitions and improved cost estimates for a next CSO control plan review in 2010. Rate impacts will be minimized to the extent possible in any new proposed control project schedules. WTD will continue to pursue grants and low-interest loans, such as the state loans recently awarded to three of the next four CSO control projects.

4.4.2 Evaluation of CSO Treatment Technologies

The RWSP calls for satellite CSO treatment for four CSO sites—King/Kingdome, Hanford/Lander, Brandon, and Michigan. Flows at these CSO sites are so high that storage

[13] New odor control policies were adopted by the King County Council in 2003. The goal of the policies is to prevent and control nuisance odor occurrences at all treatment plants and conveyance facilities to standards that go beyond traditional odor control. Standards apply to both existing and new facilities.

facilities to hold all the flows would be large, difficult to site, and prohibitively expensive. Even if such storage facilities could be built, they could not be drained to regional plants before the next storm begins to fill them again.

As part of its ongoing planning, the County searches for new technologies that can increase effectiveness, meet new and more stringent permit requirements, and/or reduce costs. For this 2005 CSO program review, studies on the newer solids removal and disinfection technologies were reviewed for quantifiable performance data that could be directly compared with performance and associated costs of the more conventional technologies.

At the time of the RWSP, conventional primary sedimentation (or vortex separators) for solids treatment and hypochlorite for disinfection were considered the best available technologies for these sites. The 2000 CSO control plan update reviewed emerging technologies for their potential application to the CSO control program. It was recommended that new technologies were not sufficiently developed to replace those included in the RWSP, that the experience of other agencies in testing and implementing some of the more promising technologies be monitored, and that pilot studies be conducted in the future.

On March 1, 2005, a technology workshop was conducted to examine the results of the most recent literature review and to discuss the suitability of the technology to meet County needs and objectives. Over 50 people attended, most representing WTD but also including representatives from Ecology and the City of Seattle. An expert panel reviewed literature results ahead of the workshop and spoke to the group on the current national experience in the use of sewer separation, optimized storage, floatables control, real-time flow control, vortex treatment, tunnel treatment/optimized storage, and high-rate disinfection.[14] No expert with experience operating full-scale ballasted-type treatment technologies for systems similar to the County's could be found to participate in the panel, an indication of the newness of this technology.

A follow-up workshop for County staff was held June 16, 2005. Results and recommendations of the first workshop were reviewed. New information on key treatment process parameters and general costs were presented, with an emphasis on the ballasted processes. Implementation issues, including operations and maintenance issues and projected process effluent quality (metals and disinfection byproducts), were discussed.

Conclusions from both workshops are that little new information has come to light since 2000 that warrants a change from the RWSP approach of storage, conventional primary treatment, and chlorine (typically hypochlorite) disinfection. As before, it was recommended that WTD continue to monitor the ballasted sedimentation and UV disinfection processes for performance data from other entities. In addition, because of the potential cost savings of smaller footprint facilities, it was recommended that pilot tests be conducted now and detailed cost estimates be developed for variations of the ballasted sedimentation process that hold the most promise. Pilot testing will begin in 2006. Appendix C provides more detail on the review process, the technologies that were considered, and the results of the review.

[14] The panel consisted of the following people: Gerry Shrope and Vernon Thompson, CTE-AECOM; Ted Burgess, CDM; Steve Merrill, Brown & Caldwell; and David Bingham, Metcalf & Eddy.

4.5 Ensuring the Program Will Honor and Be Consistent With Long-Standing Commitments

The RWSP CSO control plan represents a responsible approach to controlling CSOs on behalf of the 34 local agencies that contract with King County for wastewater conveyance and treatment. The plan takes into account commitments made to these agencies and to communities and regulatory agencies through agreements and other mechanisms. In keeping with RWSP policy commitments, the plan will be modified, when needed, to respond to emerging developments in science and technology and to changes in regulatory requirements.

The County is upholding the agreements made by the King County Executive and the Regional Water Quality Committee (RWQC) in 1998 at the Robinswood conference center. The "Robinswood" agreements laid out guiding principles for funding the RWSP. It was agreed that the wastewater system is a regional system and that King County will do the following:

- Maintain a uniform monthly sewer rate for both existing and new customers such that, in general, existing customers pay for the existing system and new customers pay for growth.
- Establish a uniform capacity charge for new customers within the service area to cover growth-related costs not captured by the monthly sewer rate.
- Develop a proposed legislative strategy for increasing the capacity charge by including in its calculation the growth-related costs in the RWSP. Build a coalition for supporting the strategy in the Legislature.
- Maintain the current rate structure until the capacity charge is changed.
- Require King County to pay 100 percent of the cost of inflow and infiltration (I/I) assessments and any pilot projects that are done to demonstrate I/I effectiveness.
- Discontinue the combined sewer overflow benefit charge (Seattle CSO payment) when changes in state legislation authorizing a higher capacity charge are passed.

In the 2000 state legislative session, King County successfully pursued changes in state law to attain greater flexibility in setting the capacity charge. Per the agreement, the County then discontinued the Seattle CSO payment.

WTD strives to meet its commitment to use ratepayer dollars wisely in a number of ways. It coordinates the CSO program with other WTD programs and agreements for maximum benefit at least cost. New technologies are monitored to ensure that the most cost-effective technologies are used. CSO and RWSP annual reports review County wastewater management and water quality programs to eliminate redundancies or conflicts in programs. The CSO control program coordinates with the City of Seattle CSO control program to identify mutual project opportunities, minimize community impacts, and ensure equitable and cost-effective programs.

WTD continues its commitment made to the public and Ecology to make steady progress toward control of all of its CSOs by 2030. Scheduling flexibility is maintained within that timeframe to take advantage of concurrent or joint project opportunities or to respond to changing needs.

The CSO control plan honors the West Point Settlement Agreement.[15] This agreement limits the footprint of the plant to the size that would enable one more expansion to 159 mgd without increasing the discharge of pollutants above that permitted by the 1996 NPDES permit. The existing plant routinely processes CSO flows, and any updates and expansions to the plant will account for CSO control.

The CSO control program supports the 1990 settlement agreement with NOAA to repair natural resource damages in Elliott Bay and the Duwamish River from City of Seattle and King County CSOs and Seattle storm drains. To fulfill the agreement, the City and County funded and participated in an effort to clean up historically contaminated sediments and conduct habitat restoration projects in these water bodies. The fund and projects were administered by the Elliott Bay/Duwamish Restoration Panel (EBDRP), made up of natural resource trustees.[16] Projects included the Norfolk remediation, the Diagonal/Duwamish remediation, waterfront assessments, and a few habitat projects. Work under this agreement was completed in 2004, at the close of the Diagonal/Duwamish remediation.

4.6 Assessing Public Opinion

WTD's ongoing public involvement program informs and engages the public and local agencies in planning, design, and operating decisions that affect them. Public involvement activities helped to shape the RWSP, including its CSO control element. The program has become more defined since adoption of the RWSP, while still remaining within the 1999 policy framework.

This section presents the CSO-related conclusions of a stakeholder committee for the water quality assessment that was completed shortly before adoption of the RWSP. It also describes RWSP public involvement processes.

4.6.1 Stakeholder Committee for the CSO Water Quality Assessment

In addition to the RWSP public process, a stakeholder committee provided valuable input to the CSO control program through the *Combined Sewer Overflow Water Quality Assessment for the Duwamish River and Elliott Bay* (WQA). The members of the committee are listed in Appendix C. Appointed in November 1996 and serving through the publication of the reports in 1999, its work included participation in full-day workshops and half-day working sessions to

[15] The West Point Settlement Agreement is an agreement made with community, civic, and environmental groups that allowed the upgrade of the West Point plant to secondary treatment to go forward.

[16] EDBRP trustees are NOAA, the U.S. Department of the Interior, the U.S. Fish and Wildlife Service, the Bureau of Indian Affairs, the Washington State Department of Ecology, the Suquamish Tribe, and the Muckleshoot Indian Tribe.

review specific details of the project, followed by preparation of a report covering key points of consensus.

The committee's conclusions regarding CSO control include the following:

- In some areas, existing sediment quality and associated risks to people, wildlife, and aquatic life in the Duwamish River and Elliott Bay are unacceptable.
- Current levels of human pathogens and fecal coliforms in the Duwamish River and Elliott Bay are unacceptable because of the risk to public health.
- Controlling CSOs according to the Executive's Preferred Plan (RWSP) will improve some aspects of environmental quality.
- Even if CSOs are completely eliminated, overall environmental quality will continue to be unacceptable.
- CSOs need to be controlled as part of the comprehensive regional program.

4.6.2 RWSP Public Involvement Activities

Since the RWSP was adopted, public opinion has been collected through a variety of venues; most are not specific to CSO control but still provide insight into the values and preferences of the public. For example, public involvement programs for I/I control, the Habitat Conservation Plan, water conservation education, water reuse, and various WTD construction projects have provided many opportunities to engage the public and hear opinions on water quality and wastewater management issues having relevance for CSO control.

To ensure a consistent approach, public involvement guidelines for WTD projects were developed to help staff develop and implement public involvement programs and coordinate public outreach activities for multiple WTD projects in the same geographic area. In addition, a comprehensive centralized database was developed that tracks public contacts and outreach activities to increase coordination and efficiency of outreach efforts.

The messages heard during RWSP formation—that water quality is a priority to the citizens of King County, that the County has a mandate to protect and enhance water quality, and that the citizens believe CSOs should be controlled—has been continually reaffirmed through all WTD public involvement activities since the RWSP was adopted. In its recent annual water quality survey, King County repeated questions asked in 1997 and heard similar results: 79 percent of respondents said that the County should prevent CSOs into Puget Sound, rivers, and lakes during storms, even if it costs more per month in our sewer rates; only 4 percent believed controlling CSOs was not worth such investments.

In preparation for the 2008 CSO control plan update to Ecology, King County will conduct a public involvement program to identify current attitudes about CSO control, control priorities, and possible schedule changes. WTD staff will also be meeting with federal, state, and tribal agencies to discuss the 2008 plan update and any proposed changes. Also, 1 year prior to the 2008 submittal of permit renewal materials, King County and Ecology will conduct a meeting with stakeholders and interested parties to hear their issues or concerns about the West Point

permit renewal. This meeting will offer another opportunity to learn of any CSO-related issues. The messages heard to date, information resulting from this program review, and any new public opinion heard during the plan updating process will shape the program to be in keeping with the expectations of our citizens.

A focused information and involvement effort in support of predesign for the next CSO control projects—Barton, Murray, Magnolia, and North Beach—will begin later in 2006 to gather community input and to provide information on the projects. The results of these meetings will give decision-makers information to consider along with technical and rate impact studies in deciding on any changes to the CSO control program.

As is done with all WTD projects, community relations plans will be prepared for construction of each CSO control project. The public will be kept informed of the project and community impacts via fliers, signs, direct contact, and 24-hour project hotlines. Staff will be available to respond immediately to questions and concerns. And control projects will include features, such as noise mitigation and odor control, to minimize long-term impacts on neighbors.

Ongoing public involvement activities indirectly related to CSO control projects include the following:

- Providing information about CSO projects to communities in conjunction with other WTD projects occurring in the area.
- Discussions with the Duwamish River Cleanup Coalition, a public outreach group convened by EPA and funded by the Lower Duwamish Waterway Group (including King County) to provide input on sediment cleanup projects and public outreach.
- Conducting a variety of public information and outreach activities including speaker's bureau, community open houses, wastewater treatment facility tours (treatment plants, CSO facilities, pump stations), and booths at community fairs and festivals.

4.7 Integrating the CSO Control Program with Other Water and Sediment Quality Improvement Programs for the Region

To save costs, improve efficiencies, and reduce redundancies, the CSO control program integrates its work with both internal and external programs aimed at improving water and sediment quality in the region.

Just as the 1998 CSO water quality assessment (WQA) provided information that could be applied to other WTD programs, these other programs generate information that is invaluable to CSO control planning. The studies done on bioaccumulative and endocrine disrupting chemicals in support of the Habitat Conservation Plan, for example, supplemented data in the 1998 water quality assessment and provided direction for future studies to better understand the role of such chemicals in planning for CSO treatment projects. WTD also coordinates with other divisions in

the Department of Natural Resources and Parks, such as the Water and Land Resources Division whose scientists routinely participate in and provide water and sediment quality information in regard to CSO control.

King County and other entities in the region conduct water quality monitoring and participate in water quality protection programs, such as the studies being done in support of salmon conservation in the two major watersheds in King County. The WTD CSO control program makes an effort to keep informed of this work, identifies new science that is relevant to CSO control planning, coordinates efforts for complementary results, and negotiates joint work where interests overlap.

The CSO control program makes every effort to coordinate CSO control projects with wastewater system upgrade and refurbishment projects to optimize designs, share mutual project costs, and minimize community disruption. For example, upgrades to the Barton Pump Station were expanded to the maximum capacity that the station can accept in order to minimize the size of the anticipated CSO control project. Likewise, emergency repairs of the Barton force main and Ballard siphon have considered CSO control plans to the extent possible without delaying the repairs. The siphon repair may control CSOs at the Ballard location without the need for a later control project.

WTD and the City of Seattle are consulting on ways to coordinate CSO control projects in overlapping areas and to handle the addition of more City CSO flows into the County conveyance and treatment system. The RWSP defined the Ballard CSO control project as a joint project with the City. Now that the Ballard project may not be needed as the result of siphon replacement, WTD has offered the City the opportunity to contribute incremental costs to provide capacity in the siphon for the City's Ballard CSOs. If the City wishes to explore this opportunity further, the implications for siphon sizing, buildability, and West Point capacity will be assessed. Other projects that will be evaluated include the City's Windermere and the County's University Regulator projects, as well as a possible joint storage project in the Madison Valley and Montlake areas. These opportunities for coordination will be considered in the 2008 CSO plan update.

The County has worked with the City and other agencies on sediment remediation and source control projects. Since 2000, King County, Port of Seattle, City of Seattle, and Boeing have been involved in efforts under the federal Superfund program to better understand the human and environmental risks from contaminated sediments in the Lower Duwamish Waterway and to take actions where necessary. As the result of early proactive discussions with Ecology and EPA before the area was listed under Superfund, the County, City, and Port have been allowed unprecedented access and participation in the initial remedial investigation and feasibility study (RI/FS). Two of the early action sites recommended in Phase 1 of the RI were near King County CSOs: Norfolk and Diagonal/Duwamish. Sediment near the Norfolk site had already been remediated in 1999 by King County, working with the City of Seattle and the EBDRP. Similarly, King County was the lead agency, with participation by the City of Seattle and funding from the EBDRP, for remediation of the Diagonal/Duwamish site, completed in 2004.